R E P O R T R E S U M E S

ED 010 386 56

CLASSROOM EPISODES FOR TEACHING PSYCHOLOGICAL PRINCIPLES AND CONCEPTS OF LEARNING.

BY- SULLIVAN, HOWARD J. AND OTHERS
ARIZONA STATE UNIV., TEMPE

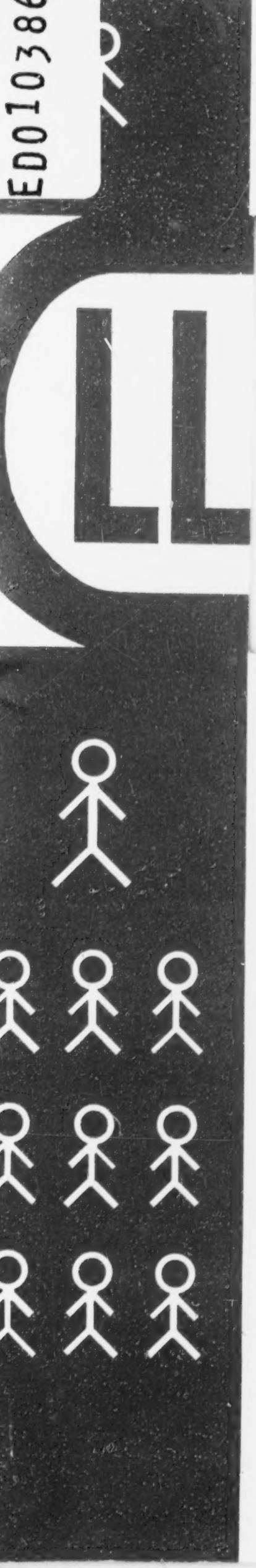
REPORT NUMBER BR-5-0894 PUB DATE MAR 66
REPORT NUMBER NDEA-VIIA-1230
REPORT NUMBER TR-9
EDRS PRICE MF-$0.09 HC-$2.24 56P.

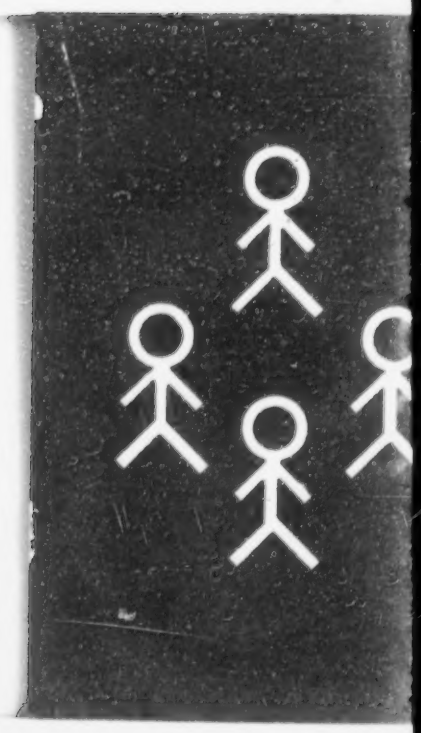
DESCRIPTORS- TAPE RECORDINGS, FILMSTRIPS, CLASSROOM RESEARCH, *CLASSROOM TECHNIQUES, CLASSROOM PARTICIPATION, CLASSROOM ENVIRONMENT, CLASSROOM COMMUNICATION, CONCEPT FORMATION, *CONCEPT TEACHING, *LEARNING PROCESSES, *TEACHER EDUCATION, *PSYCHOLOGICAL PATTERNS, INSTRUCTIONAL MATERIALS, TEACHING TECHNIQUES, TEACHING GUIDES, SEQUENTIAL APPROACH, TEMPE, ARIZONA

THE 16 CLASSROOM EPISODES PRESENTED IN THIS REPORT WERE SELECTED BECAUSE (1) THEY RELATE CLOSELY TO IMPORTANT PRINCIPLES AND CONCEPTS OF LEARNING AND (2) THEY HAVE HIGH INSTRUCTIONAL VALUE FOR PROSPECTIVE TEACHERS. IN DEVELOPING THE EPISODE MATERIALS, THE INVESTIGATORS PHOTOGRAPHED AND TAPE RECORDED WIDE VARIETIES OF CLASSROOM EVENTS FROM ONGOING SCHOOL PROGRAMS. TYPESCRIPTS OF THE TAPE RECORDINGS WERE PRESENTED, AND THE PRINTED FILMSTRIPS THAT ACCOMPANIED THE TYPESCRIPTS DISPLAYED THE ACTUAL CLASSROOM SCENES FROM WHICH THE RECORDINGS WERE MADE. THE CLASSROOM EPISODES WERE SEQUENCED FOR EFFECTIVE INSTRUCTIONAL USE AND PRESENTED (1) INSTANCES OF SEVERAL IMPORTANT LEARNING PRINCIPLES AND CONCEPTS, (2) DIFFERENT STAGES IN SINGLE INSTRUCTIONAL LESSONS IN WHICH STUDENTS FAILED TO ATTAIN THE OBJECTIVE, AND (3) INSTANCES IN WHICH LEARNING PRINCIPLES AND CONCEPTS WERE APPLIED EFFECTIVELY. INSTRUCTIONAL NOTES AND A GLOSSARY OF CONCEPTS WERE INCLUDED WITH EACH EPISODE. (GC)

ED010386

5-0894
VII A 1030





CLASSROOM LEARNING LABORATORY

experimental analyses of student behavior

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education
This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

Department of Educational Psychology
Arizona State University
Tempe, Arizona

Classroom Episodes for Teaching Psychological Principles and Concepts of Learning

Howard J. Sullivan, Robert L. Baker
and Richard E. Schutz

TR Series 9
March, 1966

The research that preceded the development of this material was partially supported by a grant from the U.S. Office of Education.

Classroom Learning Laboratory
Arizona State University
Tempe, Arizona

TABLE OF CONTENTS

CONTENTS PAGE

INTRODUCTION 1

TYPESCRIPTS OF CLASSROOM EPISODES. 4

GLOSSARY OF CONCEPTS 35

INSTRUCTIONAL NOTES. 37

INTRODUCTION

Educational psychology courses devote considerable attention to selected principles and concepts of learning. The student learns formal definitions and reads textbook examples of the important concepts and principles most closely related to school learning. Given a clear-cut verbal example of a concept of learning, the student frequently is able to identify or name the concept that is exemplified. However, he is usually much less successful in relating the concepts to the school classroom. For example, when observing in an actual classroom setting in which concepts of learning can be observed, the student typically cannot identify those same concepts he previously identified in an exclusively verbal context. Again, when observing ongoing classroom activities, few students can specify ways in which learning principles might be applied. Clearly, teacher trainees need training with materials that illustrate concepts and principles of learning and their application in the classroom setting.

Typical observation procedures are inefficient in providing for the identification and application of learning principles. The student normally visits the school classroom individually or in small groups and observes the events that take place. He does not receive systematic training in identifying concepts of learning or in analyzing pupil behavior. There is no efficient way of directing his attention to the application or lack of application of relevant principles of learning employed in the classroom. It is not feasible in this context to provide him with training and practice in specifying instructional procedures that effectively apply principles of learning to facilitate pupil performance.

The materials presented in this guide overcome many difficulties inherent in the typical observation procedure. These materials present a number of actual classroom events that illustrate important principles and concepts of learning. They may be used by an instructor to introduce these principles and concepts and to provide the students with training in identifying the concepts as they occur in the natural classroom setting. In addition, the materials provid an opportunity to specify instructional procedures that effectively apply principles of learning to develop desired pupil behaviors.

In developing these materials, a wide variety of classroom events from the ongoing school program were simultaneously photographed and tape recorded. Verbatim typescripts were prepared from the tape recordings, and the printed filmstrips that accompany the typescripts show the actual classroom scenes as the recordings were made. The episodes included in this guide were selected from tape-filmstrip materials recorded in several different elementary schools and at grade levels ranging from kindergarten to the eighth grade. The sixteen classroom episodes chosen for presentation were selected because (1) they relate closely to important principles and concepts of learning and (2) they have high instructional value for prospective teachers.

An Instructional Notes section is included after the presentation of the classroom episodes. The purpose of this section is to call attention to the principles and concepts of learning illustrated in each episode and to suggest ways in which the instructor may use each episode in an instructional setting. Only the dominant principles and concepts of learning are noted for each episode. The instructor may find several additional principles or events from each episode that are useful in working with a particular group of students. Also, he may interpret the behavior from a variety of theoretical viewpoints depending upon his objectives and the level of sophistication of his students. A glossary of concepts is presented before the Instructional Notes section to provide definitions for the concepts and principles discussed in that section.

The sixteen episodes are sequenced for effective instructional use. The first four episodes present clear-cut instances of several important learning principles and concepts as they are seen in a classroom situation. These episodes are well suited for introducing the relevant concepts and principles to beginning students. In addition, they may be used to provide practice in the identification of the principles in an applied setting for students who previously have studied them in a verbal context. Episodes 5-8 present instances of additional concepts and demonstrate the application of several important principles in an instructional setting. The third sequence of episodes shows four different stages in a single instructional lesson in which many of the students fail to acquire

the behavioral objective of the lesson. This sequence provides an opportunity for students to analyze the instructional procedures and to attempt to specify effective instructional techniques that apply the learning principles from earlier episodes to develop the desired learning. The final four episodes illustrate several instances in which principles and concepts from earlier episodes are applied effectively. These episodes also provide additional opportunities for students to specify methods of applying several different principles of learning to attain instructional objectives related to the learning tasks that are illustrated.

It should be emphasized that the purpose of the materials is to provide slices of behavior that can be used to illustrate principles and concepts of learning. They were not intended to be used to illustrate degrees of teaching effectiveness. Since the episodes are taken out of context they frequently fail to do justice to the teacher's behavior. It is difficult to discuss any set of stimuli without imposing evaluative statements. However, we strongly urge that instructors stress the descriptive purpose of the materials and discourage evaluative references to the teachers.

TYPESCRIPTS OF CLASSROOM EPISODES

Episode 1

Background -- Episode 1 takes place in Mr. Smith's fifth-grade arithmetic class. Mr. Smith opened the lesson by briefly reviewing with the class the procedure for adding fractions with like denominators. He presented two "fractions" with like letter terms (2/a + 5/a) as denominators and elicited the proper addition procedure from the class. This episode begins a few minutes after the short opening review as Mr. Smith makes reference to an earlier lesson which apparently covered the addition of fractions with unlike denominators.

Mr. Smith: Then last Friday we had something that looked like this.

(Mr. Smith writes problem on board)

Mr. Smith: Okay, 1/2 plus 1/4. Do you remember what to do? Okay, go up and write on the board Tell us what to do.

Dave: You add. There's 1 and 1. That's 2. And the 2 and 4 is 6. It's 2/6.

Mr. Smith: And you've divided? Okay, let's let him carry it through. Let's see what he does.

(Student talking)

Mr. Smith: That's as far as you can go? Okay, how many agree with him?

Student: I can't even see what he's doing.

Mr. Smith: You think you know what to do?

Student: I think I do.

Mr. Smith: What do you think he did wrong?

Student: Well, I think he was supposed to change the 1/2 into fourths.

Mr. Smith: All right, why?

Student: Because the denominators are not the same.

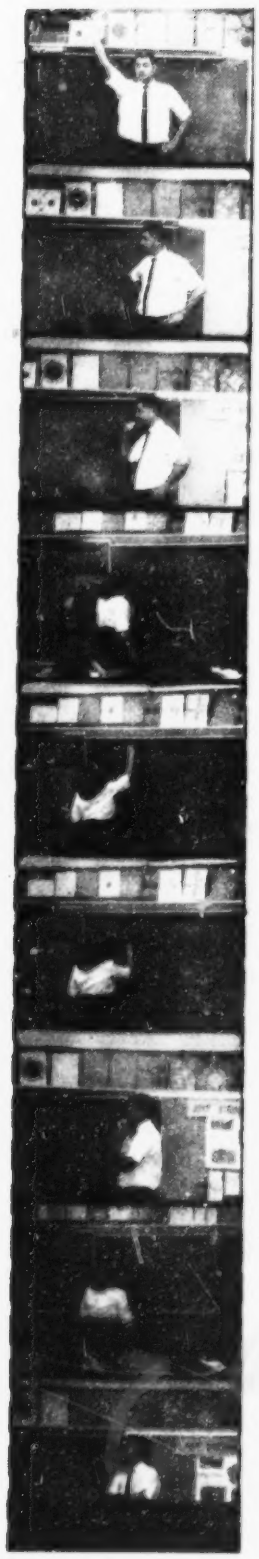
Mr. Smith: The denominators are not the same. All right, do you remember our X and Y here?

(Speaking to a girl in class) All right, go ahead and try it.

(Student writes on board)

Mr. Smith: Okay, do you agree, Scott?

Scott: Yes.



Episode 2

Background -- After the close of Episode 1, Mr. Smith briefly talked through the procedures used by the girl at the board who did the problem correctly near the end of the episode. The present scene began about one minute after the close of Episode 1, immediately following Mr. Smith's review of the first problem.

Mr. Smith: Okay, wanna try another one, Dave?

Student: Yah.

Mr. Smith: Huh?

Dave: Ah, I don't know.

Student: I do.

Mr. Smith: Try this one: 1/4 plus 1/8. Can you do that one?

(Pause as Dave works at board)

Mr. Smith: Okay, look it over. See if you've done everything you're supposed to do.

Okay. Now, turn around. Look at the class. How many agree with Dave?

Okay. Are you a success?

Dave: I guess so.

Mr. Smith: You guess so. I think you're right.

Episode 3

Background -- Episode 3 is from Mr. James's sixth-grade arithmetic class. Mr. James has divided the class into two sides, and he chooses a student from each side to work a problem at the board. The student who writes the correct answer first is allowed to make a mark for his side in the tic-tac-toe grid that is seen in the filmstrip.

Mr. James has given each pair of students who went to the board previously during this lesson a problem in addition, subtraction, multiplication, or division. These problems involved whole numbers only. There was no instructional phase of the lesson, since the students already have learned to add, subtract, multiply, and divide whole numbers.

Mr. James: 24,906.

(Writing at board with students laughing in background)

Student: That's an "O"?

Mr. James: All right, let's keep the audience out of this. They can do it without any help.

18,303.

Subtract.

(Long pause as students at board work problem)

Mr. James: All right, you'll notice that there is a little difference in the answers. Would you read yours to us, Carol. I can't tell what that last hieroglyphic was.

Carol: 6,603.

Mr. James: 6,603. (Then speaking to Janet) You had 6,703. What is 3 from 6?

Janet: Three from 6 is 3.

Mr. James: And 0 from 0?

Janet: Zero.

Mr. James: What's 3 from 9?

Janet: Six.

Mr. James: What did you say, Janet?

Janet: I said I goofed.

Mr. James: What seems to be wrong?

Janet: The 6.

Mr. James: What did you have?

Janet: Seven.

Mr. James: All right. You take 8 from 14. Hold the fort. What's 8 from 14?

Janet: Six.

Mr. James: Six. And that leaves 1 from 1. All right, we have an "X" to put up.

Episode 4

Background -- This episode takes place in Miss Johnson's fifth-grade arithmetic class at Jefferson School. The students have just finished marking each item on their own papers correct or incorrect after a member of the class reads the correct answer. The papers cover an arithmetic assignment from the preceding day.

Jefferson School services a very low-income, poverty-ridden area. Its students are almost exclusively Mexican and Yaqui Indian, and English is a second language for these students.

Miss Johnson: Would you put the number wrong, please, at the top of your paper. And I'll give you just a minute to find your mistakes. Find out what you did wrong.

Do you know why we do this? So you won't make that same mistake again. Will you?

All right, real quickly find your errors. If you got 100, then you don't have any errors to find. If you can't find it, raise your hand. Perhaps you copied it wrong.

(Pause. Students check papers)

Miss Johnson: Did you find them? Maybe your neighbor can help you find them if you can't.

(Students checking papers)

Miss Johnson: Done? You may pass these papers in.

(Pause. Papers being passed in)

Miss Johnson: Then would you take out your fraction kit, please.

Episode 5

Background -- These scenes are from a reading readiness class in Mrs. Wilson's kindergarten room. Cards showing a letter, a short word, a color, a picture of a fruit, and other common stimuli are contained on a stand at the front of the room. Mrs. Wilson asks a student to name the stimulus on a certain card. If he names it correctly, he is allowed to get the card and take it to his seat. During the lesson in progress, there has been no formal instruction designed to enable the students to correctly name the stimuli depicted on the cards.

Mrs. Wilson: What is the small letter on the left hand side?

Student: Small "e".

Mrs. Wilson: Nope.

Student: Small "b".

Mrs. Wilson: Right. Will you get it, Ramona?

(Pause. Student talking)

Mrs. Wilson: All right, now I'm ready to start putting some of these back. You look here.

I'm going to say one thing. I'm going to say your name. You will tell me what this is. If you get it right, you can put it back. If you don't say it right, somebody else has a turn.

Tracy?

Tracy: "P"

Mrs. Wilson: Victor?

Victor: Red.

Mrs. Wilson: Right. Martin?

Martin: Blue.

Mrs. Wilson: Right. Michael?

Michael: Yellow.

Mrs. Wilson: William?

William: Color.

Mrs. Wilson: Dora?

Dora: "A"

Mrs. Wilson: Nope. Now wait a minute, take a look at it. Steven Alpaugh?

Steve: The.

Mrs. Wilson: Right. Cheryl Beatty?

Cheryl: "O"

Mrs. Wilson: Richard?

Richard: Orange.

Mrs. Wilson: Maria?

Maria: (inaudible)

Mrs. Wilson: Ramona?

Ramona: Look.

Mrs. Wilson: These are all going back. If you have an "A" put it away.

Episode 6

Background -- Episode 6 also takes place in Mrs. Wilson's kindergarten class. Mrs. Wilson is preparing to read the students a story about ten apples. She began the lesson by having the students count circles on a board at the front of the room in much the same manner that they are counting apples in this episode. In these scenes Mrs. Wilson is pointing out to her students different quantities of apples pictured in the storybook.

Mrs. Wilson: All right, let's start counting apples.

Mrs. Wilson and Class: 1-2-3-

Mrs. Wilson: Michael, how many?

Michael: (inaudible)

Mrs. Wilson: Tessy, how many?

Tessy: Three.

Mrs. Wilson and Class: 1-2-3-4-5-6-7-8-9-10

Mrs. Wilson: How many apples?

Class: Ten.

Mrs. Wilson: Vicky, how many apples?

Vicky: Ten.

Mrs. Wilson: Tessy, how many apples?

Tessy: Ten.

Mrs. Wilson: Randy, how many apples?

Randy: Ten.

Mrs. Wilson: Our story today is about ten apples. This many apples. 1-2-3-4-5-6-7-8-9-10. Will you clap that many for me?

Episode 7

Background -- This episode is taken from a spelling lesson in Mrs. Frank's first-grade. Mrs. Frank has introduced her class to their first spelling word for the week, "is". As this episode begins, she has just finished writing the word on the board.

Mrs. Frank: All right, everyone look at our word "is". Let's spell "is" together.

Class: Is, i-s, is.

Mrs. Frank: Fine. Now, put your finger pencils up in the air. Ready?

Class: Is, i-s, is.

Mrs. Frank: What does the "i" have? Right up here. Steven?

Steven: A little dot.

Mrs. Frank: Right, and it's very important that we don't forget the little dot, isn't it?

Let's try "is" with our fingertips just once more.

Class: Is, i-...

Mrs. Frank: Don't forget the dot!

Class: -s-, is.

Mrs. Frank: Good. Now, close your eyes and see if you can write it.

Class: Is, i-s, is.

Mrs. Frank: Good. Most of you remembered your dot. Can you write "is" on the board for us? Clark?

(Clark writes on board)

Mrs. Frank: Fine. Now spell it, please.

Clark: Is, i-s, is.

Episode 8

Background -- Episode 8 takes place in Mrs. Short's first-grade. The students in the reading group shown are studying the sounds "made" by different consonant blends. The technique is for Mrs. Short to present a flash card showing both the letters in the consonant blend and a picture of an object whose name begins with the letters shown on the card.

Mrs. Short: Oh!

Student: A new one.

Mrs. Short: All right, now. Jim is asking, please, so we can hear his sounds, everybody be very quiet. And I think that's a good thing.

RaeJean?

RaeJean: I've got a...

Mrs. Short: Yes, we do. Use the hard sound of the "C" here.

Student: sk-,sk-,sk-

Mrs. Short: Let him do it, though.

As in scooter, as in scooter. This is just really like s-k, too. Jim?

Jim: smm-, as in...

Mrs. Short: As in smoke.

Students: Oooo--what a creature! What a creature!

Mrs. Short: Now, what is this interesting...?

Students: Snail.

Mrs. Short: RaeJean says this is an interesting creature. Just a minute.

(Students whispering)

Mrs. Short: As in?

Student: Snail.

Mrs. Short: Isn't he an interesting creature? I like that word creature.

We used to have a snail in our big fish bowl.

All right, Clark.

(Student noises)

Clark: sp-

Mrs. Short: As in? Spear, good.

Now, lookie here. Now you've got three consonants; a triple-consonant blend.

Students: sprrr-

Mrs. Short: As in sprinkler.

Episode 9

Background -- This lesson is the first experience that Mr. James's sixth-grade class has had with cross cancellation. This episode and the three that follow it are all taken from the instructional phase of the cross-cancellation lesson in Mr. James's class. The behavior which the instructor is attempting to develop during the lesson is the correct use of cross-cancellation procedures in multiplying proper fractions. The class had studied reducing of fractions earlier in the year, and the relevant entering behavior is the ability to reduce a fraction to its lowest terms.

Initially, the teacher spent a minute or so introducing the word "canceling" and telling the class that canceling is the technique for reducing the size of the numbers that one works with in multiplying and dividing fractions. He then wrote one fraction (4/8) on the board and reduced it to its lowest terms, explaining that canceling is something like reducing fractions. Episode 1 begins about two minutes after the start of the lesson, just after the teacher has written a multiplication problem (3/4 x 8/15) on the board. This problem represents the first instruction and example presented to the class on the procedures involved in cross cancellation.

Mr. James: All right, this is the same idea as canceling. You look at a problem that's set up in this manner and if there is a number you can use--if you can divide both sides on an angle, the numerator on one side, the denominator on the other; the numerator up here, the denominator there--if either of those are divisible, then you can use it.

In this case, you can see, I hope, that 4 will work. So we can divide 4 by 4: that's one. You divide 8 by 4: you get 2. You divide 3 by 3: you get 1. You divide 15 by 3 and you get 5.

Now, we actually have not changed anything. We now have 1/4 and 2/5.

Steve: Unh-uh.

Mr. James: Oh, what has changed, Stevius?

Steve: Well, 3 into 15 will go 5 times.

Mr. James: All right. Look, we've got the 5 here, but I fooled you on this one. We now have one over one. No changes at all.

See, I fooled you, I said the 4 but we have already eliminated the 4--we've divided. So that this then becomes nothing more than 1. So, if you multiply 1 times 2/5, what do you get?

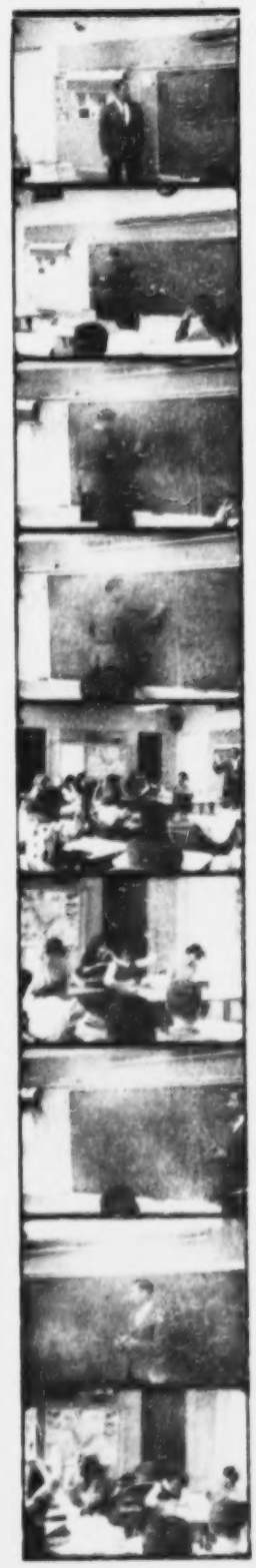
What's 1 times 2/5? Charlie?

Charlie: Two-fifths.

Mr. James: Two-fifths. We haven't changed it all, have we?

Episode 10

Background -- The events in this episode took place moments after the conclusion of events depicted in Episode 9. The problem that Mr. James writes on the board (4/17 x 51/64) is the second problem example for cross cancellation presented to the class.



Mr. James: Let's try another one and see what happens.

Now can you see that one? We'll remove the background here so you don't try to do two problems at once. Now in looking at this one, how many of you can see a cancellation possibility?

(Girl responding to Mr. James's question)

Mr. James: I said <u>see</u>, Jill. Your eyes somehow seem to need to be connected with your teeth. Look at the problem. Is there any opportunity for cancellation there?

Some of you are looking at me. I'm sorry, I can't be cancelled. Eliminated and erased--yes, but not cancelled.

<u>Look at the problem</u>, <u>please</u>! Are there any relationships in these numbers that can be utilized to cut down the size of your multiplication? And that's all your doing. You're going to do a little dividing first; then you can multiply a smaller set of numbers.

One or two people seem to have seen it, the rest of you are writing on your desk tops. These are not that large. You should be able to do your head-work on this, not your handiwork on the table tops, please. All right, Carl, what suggestions do you have?

Carl: Well, 4 into 64. The 4 would be 1 and 64 would be 16.

Mr. James: All right. The 4 and the 64 are divisible. You use 4 and so this would have to come out 16. So we've cut that down into a fair-to-middling bite size. Charlie, what else do you see there?

Charlie: Seven into 51.

Mr. James: Seven?

Charlie: I mean 17!

Mr. James: Oh, 17. All right, 17 this time is a multiple of 51. And that's a 3, isn't it?

Debbie, what's your problem?

Episode 11

Background -- The events in this episode are a continuation of those in the preceding one. The problem on the board, then, is the third problem presented in this initial lesson on cancellation.

Mr. James: Debbie, what's your problem?

Debbie: Well, all the other side--that thing up there--wouldn't it always be 1? Because you always divide 17 into 17 and it's 1.

Mr. James: Try to make sure that this...Try that one, Deb. Now, you see, you can do some cancellation here.

Anyone see where you can do some canceling in this one? Go ahead. What could we do?

Student: Well, it doesn't come out even.

Mr. James: Yes, it does. Does anyone see any cancellation in this? Oh, we have to go back to our tables. I don't mean writing on them, either! You don't know your tables of...Debbie.

Debbie: Three.

Mr. James: Three!...Now, how about the 5 and the 16--any relationship there?

Student: No.

Mr. James: No. No relationship there that will come out even.

Student: (inaudible)

Mr. James: Pardon?

Student: How come that's 7?

Mr. James: Well, I divide 21 by 3 and I get 7. What do you do?

Debbie: Oh!

Mr. James: You're using 3 as your common divisor this time. It doesn't come out to 1; that's what I was trying to show you, Debbie. You were trying to get the idea that because so many that we did did come out with just 1 on this side, that it can come out entirely different...

Debbie: Can you cancel out the 3 and have it go into 21...

Mr. James: No. We use 3 to divide 9 by and the 21 by. We cut this one down from 9 to 3, and this one from 21 to 7, but you can't go any further. They are not divisible now by any number. So we have 3/16 and 5/7, as such...

Episode 12

Background -- The events in this episode took place approximately fifteen minutes after the conclusion of Episode 11. The opening remark by Mr. James apparently is intended to conclude the instructional session which is to be followed by a textbook assignment covering cross cancellation in the multiplication of proper fractions.

Mr. James: That means that all of you understand canceling, including Rod? Why aren't you asking questions then?

(Student mumbles response)

Mr. James: You don't even know enough to ask a question? Where did you get lost?

Rod: I don't know how to do it.

Mr. James: Don't know how to do what?

Rod: Canceling.

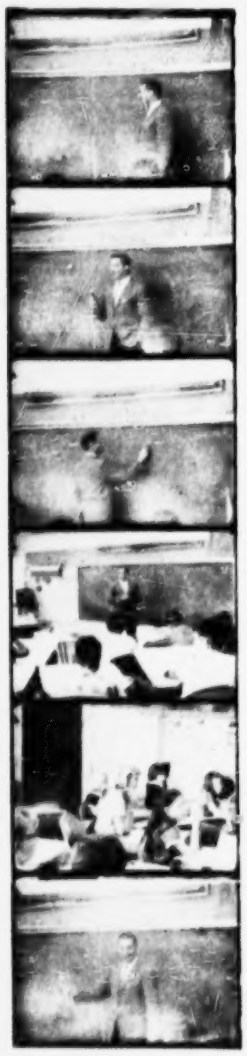
Mr. James: How do you know you don't know how to do it? Let's try a nice easy one.

(Writes problem on board)

Mr. James: Can you cancel in that one, Rod? Don't you have any idea what we did at all?

Rod: No.

Mr. James: Oh, come on, you couldn't be lost that far unless you weren't paying attention. Let's see, who else might be unsure of themselves? No, not that know. Who else might be unsure? Who else had questions? Don't leave Rod hanging here all alone! He'll catch his death of foolishness hanging out there all alone. Come on, there are more.



Nadine, where do we cancel in this problem?

(Nadine mumbles reply, and students laugh)

Mr. James: See, I told you you wouldn't be hanging alone. We just hung another one with you. I don't know if that's any advantage, but we just hung another one, anyway. Miss Betz, how come you weren't asking then, if you don't know?

Do you see this, both Rod and Nadine?

Nadine: No. What?

Mr. James: Do you see the relationship of these numbers across the sign? That they are both divisible by the same number?

They're both 3's, so you can divide it by 3, right? So if you divide this one by 3, you end up with one. This way, you're trapped. You can't do anything because it's already down low. What is 1 times 1, Rod?

Rod: One.

Mr. James: How about that? What's 4 times 1, Nadine?

Nadine: Four.

Mr. James: Four. Now, let's try this in terms of just thinking about it.

Episode 13

Background -- Miss Johnson's fifth-grade class at Jefferson School has just begun studying problems involving subtraction of a fraction from a whole number. At the beginning of the lesson, Miss Johnson talked the class through a problem in which each student used his fraction kit to compute the answer. She then gave them a second problem (1 - 1/3) to work with their fraction kits. Miss Johnson wrote the problem on the board and after the students had computed the answer using their kits, she had them talk her through the correct steps in solving it on the board.

Miss Johnson gave her class their first problem to solve on paper (1 - 1/8) about five minutes after the beginning of class. She has just finished allowing them time to work this problem individually at their seats as the present episode begins. During the time that students worked the problem at their seats, Miss Johnson circulated among the class, saying "very good", "that's right", etc. to students having the correct answer.

Miss Johnson: All right. What did you get, Arminda?

(Pause. No response)

Miss Johnson: All right, let's work it together.

What does 1 equal, Arminda? Here, what do we have to change?

We can tell just by looking, can't we, that we can't take an eighth away from a whole? Isn't that right? You all saw that when working with your fraction kit. So what do we have to divide this one whole into?

Students: Eighths.

Miss Johnson: How many eighths in a whole?

Student: Eight.

Miss Johnson: All right, now I'm ready to subtract. All we have to do is say 1 from 8 are _____.

Students: Seven.

(Pause. Miss Johnson points to denominator place in answer)

Students: Eighths.

Miss Johnson: All right, try another one. We're just going to work with ones today. Tomorrow, we'll get to mixed numbers. Other numbers.

(Miss Johnson writing 1 - 1/6 on board)

Miss Johnson: Be sure you put 1 equals. Equals.

(Pause. Students work problem at seats)

Miss Johnson: Oh, these are too easy for you. Alva?

Alva: Five.

Miss Johnson: Five-sixths.

Did anyone get something else? What did you get, Ruben?

(No reply from Ruben)

Miss Johnson: All right, how did you get 5/6's? What does 1 equal, Alva?

Alva: 6/6.

Miss Johnson: Six?

Alva: 6/6.

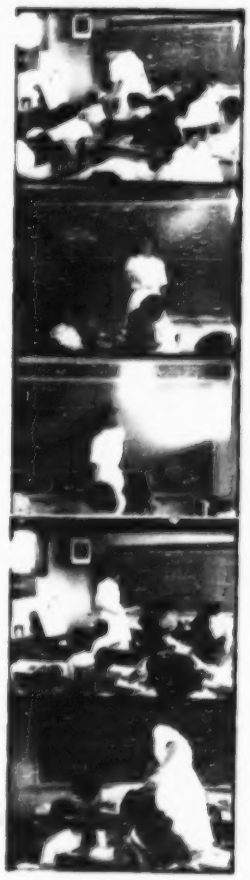
Miss Johnson: I'm not writing it very well. Remainder?

(Some students answering 5, others answering 5/6)

Miss Johnson: Want a hard one?

Episode 14

Background -- This episode immediately follows the preceding one in Miss Johnson's class. The problem that she gives the class is the "hard one" that she referred to at the end of the last episode. It represents the third problem of this type that the class has worked on paper.



Miss Johnson: Okay. Are you ready for a hard one?

All right. One take away 7/20's.

(Pause. Students working problem)

Miss Johnson: When you get the answer--the remainder--you may raise your hand.

(Pause)

Miss Johnson: Somebody is fast. Very good. Bern? What did you get, Bernadino?

(Reply mumbled)

Miss Johnson: You didn't get it? All right, let's help him get it. Let's everybody get it.

All right, let's put down our pencils and look at the board. Bernadino, what does 1 equal here? How many parts am I dividing this into?

Bernadino: Twenty.

Miss Johnson: Twenty. Very good! So how...what does 1 equal?

Bernadino: Twenty.

Miss Johnson: Twenty what? Twenty _____?

Bernadino: Twentieths.

Miss Johnson: Twentieths. 20/20. One equals 20/20. What do I have to do now?

Students: Subtract.

Miss Johnson: Subtract 7 from _____?

Students: Twenty.

Miss Johnson: Which is?

Students: Thirteen.

Miss Johnson: How many got 13/20?

What did you get, Joe? Nothing? Do you know how to do it?

Let's see a couple more, some of you aren't sure.

Episode 15

Background -- This episode takes place in Miss Johnson's class several days after Episodes 13 and 14. In the instructional phase of the arithmetic lesson on the previous day, Miss Johnson had taught the class how to subtract mixed numbers in which the fractions have common denominators but the numerator in the number to be subtracted (subtrahend) is larger than the numerator in the number from which it is to be subtracted (minuend). Sample problems of this type are 7 3/8 - 4 5/8, 3 1/3 - 1 2/3, 4 1/5 - 3 4/5, etc. In all problems of this type, of course, it is necessary to borrow one from the whole number in the minuend and to convert it into a fraction so that the numerator in the subtrahend can be subtracted from the numerator in the minuend.

In a lesson previous to the one described above, Miss Johnson's class had learned to subtract mixed numbers in which the borrowing process is unnecessary because the fraction in the minuend is larger than that in the subtrahend (e.g., 7 5/8 - 4 3/8, 3 2/3 - 1 1/3, etc.). However, while learning the type requiring borrowing as described in the paragraph above, they did not practice any of the latter problems and no direct reference was made to this type of problem. Then, the assignment that followed the instructional phase of the lesson dealing with problems requiring borrowing included both types of problems, those requiring borrowing and those not requiring borrowing. As the present episode begins, Miss Johnson is providing feedback to the class on their performance on this assignment. Her comments at the beginning of the episode indicate that several students used the borrowing process on all problems of both types.

Miss Johnson: And this, boys and girls, is something that many of you do not seem to understand. If I give you all problems like this, you get them right; you know what to do. But this one I mixed up--other types of subtraction problems. You do the same thing.

Do you know why? You are not thinking. Every time before you start a problem, think--do I need to change the other numbers? If you do not <u>need</u> to, then it is wrong to do it.

And after all, we are learning these fractions so that we can use them in later life. If we do need to use these fractions, boys

and girls, would they always be the same kind? Will they?

Students: No.

Miss Johnson: No. You're going to have to think, "What do I have to do?"

Will you go up to board for us please, Mary Lou, and do that second one. Please. Right on the board. Second problem.

Let's have...uh, who hasn't answered today? Gloria, you may go and...Maybe I put those just a little bit too close together here. You may come and do this one.

Now think before you start--do you need to change the number?

(Pause. Mary Lou and Gloria working at board)

Miss Johnson: She didn't change it. Why?

Well, should she have changed it? Maybe she should have? Should she have?

Students: No.

Miss Johnson: Why?

Student: Because...(Several students reply)

Miss Johnson: All right, there's no need to, because you can subtract.

Episode 16

Background -- Episode 16 takes place as Mrs. Short is working with a small group of students during a lesson in language. Mrs. Short picks several different words which sound alike except for the opening sound, and she calls upon individual students to spell them correctly.

Mrs. Short: All right, now let's start with a word that we know. Could..

Student: Could.

Mrs. Short: All right. Raise your hand please, if you can spell would. Not the kind of wood in a chair, but I would like to do that for you. Would--that would.

All right, Laurie, please.

Laurie: w-

Mrs. Short: w-

Laurie: o-u-l-d

Mrs. Short: All right, now, she took could, she took away the "c" and she put a "w". All right. Should. Should.

Jim, you haven't done this for a long time.

Jim: t-h

Mrs. Short: Shhould. That would be "thould".

(Students talking)

Mrs. Short: Now listen!

Jim: s-h

Mrs. Short: Right, Jim! Good!

Student: Hey, Mrs. Short, somebody...

Mrs. Short: Now listen, one of the...Greg...listen! One of the reasons that we have trouble is that some of us talk out and aren't thoughtful of others.

All right, now let's start again with Jim, and would everyone else--RaeJean and Greg--be very quiet when it's his turn.

Okay.

Jim: s-h-o-u-l-d.

Mrs. Short: Wonderful! Now, did you hear that!

* GLOSSARY OF CONCEPTS

Definitions are provided below for only those principles and concepts of learning given specific treatment in the Instructional Notes section of this manual.

Stimulus generalization -- A response is elicited by stimuli similar to the stimulus to which the response was originally learned. (1, 2, 10, 11, 15, 16)

Discrimination -- A response which through generalization has come to be elicited by more than one stimulus is elicited by the original stimulus and other appropriate stimuli but extinguished to inappropriate stimuli to which it had generalized. (1, 2, 15)

Extinction -- An existing response to a particular stimulus decreases in frequency upon repeated presentation of the stimulus without subsequent reinforcement. (1, 2, 15)

Reinforcement (Positive) -- A stimulus condition whose presentation increases the frequency of the response that it follows. (2, 3, 5, 9, 13, 16)

Cueing -- Presentation of stimulus elements that increase the probability of a desired response to the stimulus with which they are presented. (3, 7, 8, 9, 12, 13, 14, 16)

Behavioral objective -- A desired outcome of instruction stated in terms of student behavior that can be observed. For example, "To write the value of X" is a behavioral objective: "To understand how to compute the value of X" is not. (3, 7, 16)

* The numbers in parentheses following each concept indicate the episodes for which the manual makes specific reference to that concept.

Knowledge of results -- Information provided by stimulus events or objects about the correctness or consequences of a response. For example, the statement "That's right" by the teacher provides the student with knowledge of results on the correctness of his previous response. Similarly, the student's inability to work a problem provides the teacher with knowledge of results on the effectiveness of his instructional strategy. (4, 8, 9, 10, 12, 13, 14, 15)

Stimulus control -- A given response is elicited by one stimulus or class of stimuli but is not elicited by other stimuli or classes of stimuli. (5, 6, 7, 8, 9, 10, 11, 12, 15)

Chaining -- A condition in which one response produces or makes effective the stimulus for the next response. This cycle may continue to occur for many responses in succession. (6, 16)

Successive approximation -- Gradually altering the nature of an acquired response to develop the acquisition of a new response. This process normally builds upon the original response through small, systematic increases in its complexity until the new response is acquired.

This concept may also be used to refer to a process in which the nature of the response remains unaltered, but the nature of the stimulus designed to elicit it is systematically changed from a highly cued "give away" stimulus to a question that provides no additional support. (7, 8, 9, 10, 11, 13, 14)

INSTRUCTIONAL NOTES

Episode 1

The error in addition made by Dave ($\frac{1}{2} + \frac{1}{4} = 2/6$) can be treated as an instance of stimulus generalization. To compute the sum, Dave adds the numerators together; then he also adds the denominators. Adding the numerators is a correct response (provided, of course, that a common denominator is first computed for both terms), but adding the denominators is not an appropriate response. Thus, Jim makes the same response (addition) to an inappropriate stimulus (the denominators) that he previously has made in addition problems to similar, but appropriate, stimuli such as whole numbers or the numerators of like fractions.

In conjunction with the illustration and discussion of the phenomenon of stimulus generalization, this episode can be used to introduce or discuss the concept of discrimination learning. Dave's performance indicates that the initial relevant discrimination he needs to make is that the denominators are not summed. This discrimination would involve extinction of the faulty generalization. Of course, Dave must learn other discriminations to correctly solve the problem. Mr. Smith may employ any of several instructional strategies (such as having the students memorize verbal rules for the correct procedures and then apply the rules, or having them perform the correct addition response under heavy initial cueing until they can eventually make the correct response without instructional cues) to develop these discriminations.

The process of extinction of a response through non-reinforcement or negative reinforcement may also be discussed as the process by which incorrect generalizations are broken down and appropriate discriminations are made.

Episode 2

Dave's correct response to the problem that he works at the board ($\frac{1}{4} + 1/8$) provides an illustration of discrimination learning. Dave's work indicates, among other things, that the generalization manifested in adding the denominators in the preceding problem has been eliminated.

Dave's discrimination learning involves the extinction of a response acquired through stimulus generalization. This episode is therefore appropriate for a discussion of the concepts of extinction and stimulus generalization. Advanced students may be asked to discuss or explain the relationship between generalization, discrimination learning, extinction, and reinforcement as seen in this episode and the preceding one.

Both positive reinforcement and the apparent effects of negative reinforcement may be seen in this episode. Note Dave's reluctance to do this problem at the board, even though he volunteered for the preceding one. The volunteering response may have been extinguished by the negative reinforcement associated with his previous failure at the board. Positive reinforcement for the learned discrimination and Dave's other behaviors in this episode may derive from the knowledge that his answer was correct and the class agreement with his answer, as well as from Mr. Smith's designation of Dave as a "success".

Episode 3

This episode provides an illustration of the concept of reinforcement. A student gets the correct answer first, and she is therefore reinforced by being given the opportunity to make an "X" for her side in the tic-tac-toe grid.

The instructor may wish to have his class discuss the question of what behavior is being reinforced in an instructional strategy of this type. Mr. James's students already have learned to do problems of the type being presented. No doubt, James is attempting to reinforce speed and accuracy, and it seems highly probable that competitive behavior is being reinforced. The effect that such a procedure would have on speed, accuracy, and competitive behavior in subsequent tasks could also be discussed.

Note that the students at their seats are not working the problems, and that several students are laughing and making gratuitous remarks. Here, the possible effects of having the students at their seats also work the problems could be discussed, both in terms of its implications for student maintenance of their

problem-working skills and for effective classroom control.

The use of cueing is also illustrated in this episode. When Mr. James has Janet check her work to find her error, he heavily cues her by talking her through each phase of the problem. It would be appropriate to explain or discuss the types of situations in which it is necessary to provide strong cues as contrasted with situations in which the student can be expected to perform the task without heavy cueing. For example, had Janet previously learned to subtract and to check her work routinely, she would be able to find her error by herself. The additional cueing would then be unnecessary.

Many educators agree that the teacher should express the desired results of instruction in terms of behavioral objectives. The relevance of this concept is very clear in the current lesson. For instance, if the instructor's objective for this lesson was for all (or a large percentage) of students in his class to display certain standards of speed and accuracy on specified types of problems, his instructional strategy would almost inevitably require all students to work each problem. A similar strategy could be employed to develop competitive behavior by having each student attempt to work each type of problem within a specified time period or at a faster rate than he had worked the last problem of that type. The present lesson conceivably would be conducted in a much different manner if the instructor were to specify behavioral objectives of the lesson.

Episode 4

This episode deals with the concept of knowledge of results (feedback). It can be used to introduce a discussion or explanation of effective and ineffective methods of providing feedback to students. Note that each student is checking his own paper and this obviously constitutes a technique for providing him with a type of feedback. In addition, Miss Johnson allows time for each student to find his errors so he "won't make the same mistake again".

Several additional techniques could be employed to enable students to effectively utilize knowledge of results in mastering the desired behavior. For example, a possible objective could be to have the students work problems of this type correctly or to correct their mistakes instead of simply finding them. In this case, the teacher would allow time for the students to not only find their errors, but also to correct them so that the problem is worked correctly. Miss Johnson's technique of having the student's neighbor help him in finding or correcting his mistakes could be used in conjunction with this approach. Also, the teacher may wish to obtain feedback from the students on their performance on each item, so that she can give further instruction on the types of items missed by the most students. This type of feedback can be obtained simply by calling for a show of hands on each item. If the teacher is interested only in the students being able to find their mistakes as Miss Johnson asks them to do, she may wish to have them mark the place where the error occurred whenever this is feasible. In this way she will be able to identify whether or not the students actually have found their errors.

Episode 5

The events in this episode provide an illustration of one technique of providing positive reinforcement for a correct response and non-reinforcement for an incorrect response. Many beginning students are able to recognize that reinforcement is being provided in this episode and to identify the reinforcing condition.

Since there was no instructional phase in the lesson, Mrs. Wilson may feel that the students already have mastered the discriminations that they are asked to make. This lesson then could be a review or practice lesson designed to insure maintenance of the previously acquired behavior. A second explanation for the lack of a formal instructional phase would be that Mrs. Wilson believes that students who cannot make the required discriminations will learn to do so by hearing a classmate make the correct response.

Students who make incorrect responses to a stimulus object in this lesson do not have a later opportunity to identify the same stimulus object correctly. The effects of allowing the erring student to identify the stimulus object after another student had identified it correctly could be discussed as they relate to stimulus control of the desired verbal response.

Note that only one student in Mrs. Wilson's class makes an overt response to each object, except in cases where the first respondent answers incorrectly. Here, the importance of overt responding in the acquisition and maintenance of behavior could be discussed. Educational psychology students may be asked to identify techniques (such as requiring whispered responses or hand-raising by those who know the correct answer) that Mrs. Wilson could use to provide for overt responses to each item from as many students as possible.

Episode 6

An important concept illustrated in this episode is stimulus control. Several students are asked to identify the number of apples pictured either after Mrs. Wilson and the class have counted three apples or after they have counted ten apples. It is clear that the students themselves need not have the ability to count three or ten apples. The number of apples counted by the class or the response by the last student serves as the stimulus controlling the student's correct response. If the objective is for the number of pictured apples to serve as the stimulus controlling the response "ten" or any other number that is pictured, there is no evidence that this objective is being achieved. Educational psychology students may be asked to identify methods by which the number of apples was controlling the responses of individual students, so that the teacher could determine which students actually can make the desired response when the controlling stimulus is the number of pictured apples.

The phenomenon of chaining also is clearly seen in this episode. Note that in the counting of apples the student's response "1" most likely is elicited by the teacher saying "1" or by visual stimulation from the first apple. This response then

results in the teacher's response "2" or the second apple becoming the discriminative stimulus for the student's response "2", and so on until the teacher stops counting or no more apples are pictured. Here again, educational psychology students can discuss the concept of stimulus control as it relates to the stimuli controlling the counting responses made by the class in unison in this episode.

Episode 7

This episode illustrates the techniques of cueing and cue reduction in learning. Initially, the students use the heavy cueing provided by the word "is" written on the board as they themselves spell it orally and write it in the air with their fingers. This is simply a form of echoic response. Later, however, the visual cue is removed as they close their eyes and write it with only the cueing provided by the verbal responses of their classmates. Finally, individual students are called upon to write it at the board with no cues provided.

The principle of successive approximation is also being employed by Mrs. Frank. Her objective is for the students to write the word "is" correctly when asked to spell it, a behavior that they cannot perform at the beginning of the lesson without cueing. She initially has the students perform a less complex behavior within their capabilities, the response of spelling the word aloud while looking at it. Subsequently, they perform successively more complex behaviors leading to the objective until they eventually are able to perform the desired behavior. Mrs. Frank's method provides a good example of the successful application of successive approximation techniques. One alternate approach that may be suggested is that the students at their seats write "is" on paper without looking at the board while Clark (and the students who followed him at the board) writes it on the board. Again, educational psychology students frequently will suggest this modification.

A discussion of the concept of stimulus control is again appropriate. Many students are able to identify the stimulus

which may be controlling the students' spelling responses at each level of cueing in this episode.

The concept of behavioral objectives is again relevant. From an analysis of this episode it is clear that Mrs. Frank's objective, as specified above, is for her students to write the word "is" correctly when asked to spell it. Note that her procedures are designed to involve student responding and to efficiently lead the students to perform the behavior specified in the objective.

Episode 8

This lesson also demonstrates the techniques of successive approximation and cueing. Mrs. Short begins with double-consonant blends, and when students have correctly pronounced several of these less complex combinations she moves on to the more difficult triple-consonant blends. Note that the required discriminations involve only those blends beginning with the letter "s".

Although a form of successive approximation is employed in working from double-consonant blends to triple-consonant blends, it can be seen that all student responses are made under heavy cueing. Educational psychology students are able to identify the picture on the flash cards as a stimulus having the potential of controlling the correct response. Here, students may be asked to suggest methods of cue reduction and successive approximation by means of which Mrs. Short's students will pronounce the consonant blends correctly when the two-letter or three-letter blends are presented without the accompanying picture. A discussion of stimulus control is again appropriate with reference to the stimulus controlling the pronunciation response of the students and techniques of bringing the response under the control of the letters in the absence of the pictured stimulus.

Knowledge of results is another concept that may be treated in this episode. In this lesson students can observe that Mrs. Short confirms the student's answers with responses such as "As in scooter", "As in smoke", etc. A number of forms of providing feedback to students are illustrated in both the previous and

succeeding episodes. These may be used to discuss the function and importance of feedback and different modes of presenting it.

Episode 9

This episode is the first in a series of four in which Mr. James's efforts at cueing and successive approximation prove ineffective. For beginning students, the educational psychology instructor may wish to demonstrate a more appropriate application of these techniques as applied to the task of cross cancellation. One approach would be for Mr. James to begin by having the students reduce several fractions to their lowest terms and write the answers at their desks. This would introduce the students to the task by allowing them to perform behavior already in their repertoire and would provide for active student responding in the learning task. Then, working with the last fraction problem that the students had reduced (such as, for instance, 4/8 that is written on the board in Episode 9), Mr. James could demonstrate how these same terms may be reduced even when they are found on opposite sides of the multiplication sign (e.g., 4/7 x 5/8). Of course, only after the students had worked several problem examples in which either no terms or one term on each side of the multiplication sign could be reduced would Mr. James illustrate that it is sometimes possible to cancel both terms on each side. At this point it would be appropriate for him to have the students solve problems such as the one on the board in this episode.

With advanced students a more appropriate procedure might be to begin by telling the students the relevant entering behavior possessed by Mr. James's class or by having them specify relevant entering behavior. The students could then specify the instructional strategies that they would employ to enable Mr. James's students to acquire the desired cross-cancellation behavior.

Note that the cueing provided by Mr. James is not likely to be effective in developing the desired student responses because the students do not make the responses involved in cross cancellation. Instead, they are made by Mr. James. Thus, there is no opportunity for the students to receive knowledge of results or

reinforcement for their own responses as they acquire the cross-cancellation behavior. In addition, there is little evidence that effective stimulus control is being established because the desired response is not being made to the eliciting stimulus.

Episode 10

Here, Mr. James presents a problem that the class apparently has difficulty solving for two reasons: they have not mastered the process of cross cancellation and the cancellation task is difficult because of the large numbers in the fractions. When this episode has been shown after a discussion of the preceding one, it has been found that even beginning educational psychology students are quick to suggest the desirability of Mr. James using fractions with small numerators and denominators until his students have mastered the cross-cancellation process. Thus, this episode can serve as a stimulus to elicit from beginning students suggestions of appropriate examples for Mr. James to use in applying successive approximation procedures.

Examples of other concepts from this episode may be cited and discussed. It is clear, for example, that the instructor is utilizing knowledge of results provided by lack of student attention to the problem when he admonishes them to "Look at the problem" and by student table-top computations and inability to cancel in this problem when he refers to the size of the numbers.

In the two cross-cancellation problems presented by Mr. James, the smaller term in each cancellation is always the correct divisor to use in the cancellation process so that this number is then reduced to a magnitude of one in each case. The implications of continuing to present problems in which the smaller term is always the correct divisor may be discussed in terms of the principle of stimulus control (i.e., the student's cancellation response may come under the control of situations in which both terms are divisible by the smaller term, but not situations in which both are divisible by a third number). Faulty stimulus generalization through failure to cancel in situations in which both terms are divisible by a third number is also a concept for possible discussion.

Episode 11

Debbie's question at the beginning of this episode ("Well, all the other side--that thing up there--wouldn't it always be one?") indicates faulty stimulus generalization from the two problem examples presented previously. This provides an occasion for further discussion and explanation of the phenomenon of generalization.

Students are sometimes able to identify the apparent basis for Debbie's faulty generalization. Note that in the first two problems not only can the two smaller terms be reduced to one, but that these two terms are found in the multiplier in each case. Thus, both terms in the multiplier have a magnitude of one after cancellation. This may account for Debbie's conclusion that "all the other side" would always be one. A question such as Debbie's therefore illustrates the need to broaden the response class potentially elicited by the first two problems by extending stimulus control to problems in which the multiplicand contains the smaller term(s). In the problem in the present episode (9/16 x 5/21) the smaller term of the two that can be cancelled is once again in the multiplier.

Once again students can be asked to specify problems that could be presented in the instructional sequence to prevent the faulty generalization made by Debbie. Successive approximation procedures designed to extend stimulus control to problems in which both terms to be reduced are divisible by a third number would dictate the presentation of such problems early in the instructional sequence. The students could initially reduce fractions such as 4/6, 6/10, etc. Then they could be given problems like 6/7 x 3/4 for canceling.

In conjunction with this episode, as well as the episodes preceding and following, a discussion of the effects of interference from competing verbal stimuli would be very appropriate.

An important point for discussion here is the fact that either Mr. James or one student from the class does the overt responding to the problems in each episode in this series. The remaining students do not make oral responses to the problems or

work them out by hand. Therefore, these students simply do not make the overt responses that they are supposed to be acquiring. There is little opportunity for Mr. James to know whether they are acquiring the desired behavior, and he also has little opportunity to utilize feedback from their performance to guide his own instructional procedures.

Episode 12

This episode provides a clear illustration of the need for an instructional strategy requiring student responses that successively approximate the desired behavior. Mr. James's students have been 'taught canceling' for nearly one-half hour, yet several of them are confused by the process and cannot work even the simplest cancellation problem.

Note the cueing employed by Mr. James in working the problem in this episode (1/3 x 3/4) with Rod and Nadine. Mr. James makes reference to the relationship between the numbers that can be cancelled, but he himself both specifies the critical feature of the relationship and makes the oral cancellation response as well as the written one. Therefore, his cueing does not control the new responses to be learned by the students, because they do not make those responses. (This relationship may be discussed in terms of the concept of stimulus control.) They simply answer the questions "What is 1 times 1, Rod?" and "What is 4 times 1, Nadine?" Their inability to work cancellation problems is not related to these questions. Here, educational psychology students should be able to identify the key responses that must be learned by students like Rod and Nadine if they are to cross cancel correctly. They may also be asked to specify effective cueing techniques for eliciting these key responses.

The importance of knowledge of results is apparent in this episode. Mr. James obtains feedback from two students on their understanding of canceling. When the feedback indicates that they do not know how to cancel, he immediately modifies his instructional strategy and presents a problem that is more appropriate to the student's present response capabilities than those

employed earlier. Students may be asked to specify other techniques of obtaining feedback that Mr. James could have employed effectively in the instructional sequence. For example, if all students had responded to every problem beginning early in the instructional sequence, Mr. James could have obtained feedback both by walking about the room to observe student performance and by a show of hands of students who got the correct answer.

Episode 13

A concept illustrated at the beginning of this episode is knowledge of results. Advanced students and some beginning students are able to make this identification. Miss Johnson quickly utilizes feedback from Arminda's failure to respond (and perhaps from other responses that she noticed in circulating around the room) to adopt the instructional strategy of working through the problem together with the class.

It can be seen that Miss Johnson also applies successive approximation procedures. In the first problem in this episode she provides several cues in working through the problem with the class, but she also has the students respond to the problem. In the second problem she provides less cueing and the students give the correct answer. Each student in the class is assigned every problem in the instructional phase and thus has an opportunity to master the desired behavior. In circulating about the room, Miss Johnson is able to provide individual reinforcement and knowledge of results for many of the students, and the student performance that she observes provide her with feedback on her own instructional procedures. After perhaps six or seven minutes of instruction, many of the students are ready to proceed to more difficult problems.

The cueing provided by Miss Johnson assumes a somewhat different form than that typically seen in earlier episodes. Miss Johnson cued the students heavily on the first problem in this lesson before the opening of this episode. For the problems in this episode, however, she allows the students to work each problem themselves. Then, after students have worked the problem,

she and the class members provide necessary cues for students who initially were unable to correctly solve the problem without cues. This is an effective technique for enabling the capable students to solve the problem by themselves.

Episode 14

This episode contrasts with Episodes 9-12 in that Miss Johnson's students are making most of the responses required to compute the correct answer under her cueing, and her techniques provide a good illustration of this concept. Students may be asked to identify instances of cueing in this episode. Attention can also be called to the cloze technique of cueing that she employs by requiring students to provide a key response in order to complete a statement that she makes. It is important to note that Miss Johnson's cueing techniques are student-response oriented, (i.e., the students, not the teacher, are making the responses required for solution of the problem) and that she does not simply keep solving problems herself while talking about how to do it.

Successive approximation again is a relevant concept. Under moderate cueing by the educational psychology instructor, many students who have viewed and discussed the preceding episodes are able to specify the task components involved in the types of problems that Miss Johnson's class is doing. Given a specified entering behavior for Miss Johnson's class, students may be asked to state the procedures that they would employ with a class in order to develop the ability to correctly solve problems of this type. Students may also be asked to specify the cues that Miss Johnson must remove in order for students like Bernadino to correctly solve these problems without instructional cueing, and to suggest procedures that she can employ to remove these cues.

Once again, Miss Johnson's use of knowledge of results can be noted. She seeks feedback from the class by asking "How many got 13/20?" She then uses this feedback to guide her own instructional procedures, assigning more problems for the students to work and receive additional instruction on when she finds that

some students have not mastered the desired behavior.

Episode 15

Students should be able to identify the process of faulty stimulus generalization shown by Miss Johnson's students who used the borrowing process in those problems not requiring it as well as in those in which it is necessary. The instructor may use this episode to explain or discuss methods of preventing faulty generalization. As this episode demonstrates, for example, it is important that students are taught not only those stimuli to which a response is to be made, but also that they are explicitly taught the stimuli to which it is not to be made in order to prevent generalization of the response to those stimuli.

Miss Johnson has discovered from the student's papers (knowledge of results) that her failure to teach the students those stimuli to which the borrowing response should not be made has resulted in generalization of the borrowing response to those stimuli. She therefore has designed the lesson so that discrimination learning will take place and the borrowing response will be made when the numerator in the subtrahend is larger than the numerator in the minuend, but it will not be made when the opposite is true. This of course, provides for extinction of the borrowing response under the latter conditions.

Stimulus control is also a key concept in this episode. The borrowing response is to come under the control of one stimulus class but not under the control of a similar stimulus class. Miss Johnson employs the effective technique of having students respond to sample problems from both stimulus classes. Students may be asked to specify an appropriate assignment designed to facilitate acquisition and maintenance of the appropriate stimulus control. The assignment subsequently made by Miss Johnson required students to identify from among a number of problems those in which they should borrow and those in which they should not, but the students were not required to work the problems.

This episode also provides an appropriate instance for a discussion or explanation of the relationship that exists between the

five concepts underlined above whenever faulty stimulus generalization occurs.

Episode 16

This episode provides an example of cueing to elicit a correct response, but cue reduction is not subsequently employed to enable students to make the response in the absence of heavy cueing. It therefore presents an opportunity for educational psychology students to specify effective learning procedures and principles that could be employed with Mrs. Short's students to achieve a specified behavioral objective. In this case the appropriate objectives would be to spell (either orally or in writing) the words "would" and "should", and the student's entering behavior would be the ability to spell the word "could". Most educational psychology students are able to identify the more obvious cueing techniques employed by Mrs. Short in this episode, such as the writing of "could" on her chalkboard and her emphasis of the "sh" sound when Jim begins to spell "should" incorrectly.

The instructor may also wish to note that this is an instance where stimulus generalization functions to facilitate learning rather than to inhibit it. The "o-u-l-d" response learned initially to the stimulus "could" is also an appropriate response in spelling the new stimuli would and "should". Of course, it is possible to provide examples of various cueing techniques that may employ the phenomenon of generalization to facilitate learning.

Note that in providing feedback to Jim, Mrs. Short twice praises him for his correct efforts. Most beginning students are able to identify feedback of this type as an example of reinforcement. Also, oral spelling provides a very apparent illustration of the occurrence of verbal chaining.